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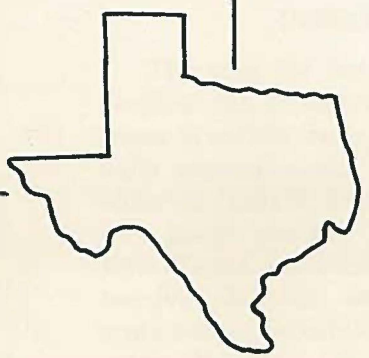

EVALUATION of ALTERNATIVE SOUTHERN PINE BEETLE CONTROL TECHNIQUES

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EVALUATION OF ALTERNATIVE SOUTHERN PINE BEETLE CONTROL TECHNIQUES

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INTRODUCTION

The need for improved methods for controlling the Southern pine beetle, *Dendroctonus frontalis* Zimm., becomes greater with each passing year. In 1951, benzene hexachloride (BHC), was first used for Southern pine beetle control. The infestation area in East Texas continued to spread despite intensive chemical control efforts. Control costs became exorbitant, the use of BHC was suspended after the 1968 field season, and a trend toward biological control surfaced.

The Texas Forest Service has been emphasizing the utilization of beetle-killed timber as the primary method for suppressing Southern pine beetle infestations. Unfortunately, trees in many infestations cannot be utilized because of their inaccessibility, size, quantity and quality. Therefore, techniques other than salvage and expensive chemical treatments are needed.

Tests to develop better alternative control techniques were recently begun at the Southern Forest Research Institute at Sour Lake, Texas. The Institute is privately endowed and is staffed by scientists of the Boyce Thompson Institute. Leroy Williamson, a member of the BTI staff, initiated intensive studies of various control methods in 1968. These studies will be reported in his Ph.D. dissertation and subsequent publications; however, it is from Williamson's work that the field examinations reported herein were patterned.

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DESCRIPTION OF STUDY AREA

A large Southern pine beetle infestation on Owen-Illinois lands in Jasper County, approximately two miles east of B. A. Steinhagen Lake (Dam B) was chosen as the study site.

The outbreak was detected July 16, 1968. The access road was heavily rutted but 150 cords of pine timber were salvaged before rainfall stopped the operation. The infestation continued to expand during 1969 and by mid-June covered approximately 15 acres when the study was started.

The area of infestation was chosen because three variables could be kept to a minimum. First, all of the trees were sawlog size. Test trees averaged 91 feet in height and diameter at breast height averaged 16 inches. Secondly, because of the abundance of emergent adults, many trees were attacked within a relatively short time. Therefore, any particular developmental stage of the beetle could be found allowing replication of treatment. Thirdly, all treatments could be made at the same time.

METHODS

Evaluation of the different control techniques was executed through the use of three series of tests. The first series contained five plots of four trees each. All trees in the plots were estimated to be in the same stage of attack. Adult Southern pine beetles were constructing egg galleries and the inner bark had started to brown. Estimated

age of the attacks was three to four days. Selected trees were randomly assigned treatments.

Each of the five plots contained a standing tree treated with cacodylic acid (Silvisar 510), a felled tree with its bole severed below the crown, a felled tree with its crown left attached, and a check or untreated standing tree.

The cacodylic acid-treated trees were frilled with an axe approximately 3 feet above the ground. One and one-half to two milliliters of the cacodylic acid per inch of tree diameter were applied to the frills with a plastic squeeze bottle.

The second of the series, using cacodylic acid only, was made on five trees just as they were being attacked by Southern pine beetles. Adult clerid beetles *Thanasimus dubius* (F.), were actively preying on Southern pine beetle adults as they were boring into the inner bark. Age of the attack was estimated as one to two days. Cacodylic acid was applied to the trees in the same manner and dosage as previously described.

In a third series of tests four trees were felled and topped and another four trees were felled but the crowns were left attached. These trees were estimated to have been attacked for 10 to 12 days. The inner bark had turned brown and the Southern pine beetle brood were in the egg and the early larval instar stages. The brood were allowed to develop in the trees.

When the brood in the test trees were ready to emerge, the check and cacodylic acid-treated trees were felled and height of attack was measured on each tree. One-tenth square foot bark samples were removed from two sides of the bole of each tree at one-third and at two-thirds of the attack height. These bark samples were radiographed with a Faxitron 8050 X-ray unit and the brood were counted by the U. S. Forest Service, Division of Forest Pest Control, Alexandria, Louisiana.

Brood from the four one-tenth square foot bark samples were counted and an average determined for each tree. This figure was then multiplied by 10 to obtain the average brood per square foot of bark surface. A comparison of brood development by treatment is given in Table 1.

RESULTS

The check or untreated trees produced the greatest brood per square foot, 144. This was a parent adult to brood ratio of 1 to 3.4.

Best results were obtained from trees under attack for one to two days which had been treated with cacodylic acid. Only five brood per square foot of bark surface were produced. Ratio of increase for this treatment was 1 to 0.2, creating a 97 percent development reduction in brood.

Cacodylic acid showed the best results, in the 3 to 4-day-old group, with only 60 developing larvae per square foot. Trees attacked for the same number of days which were felled and the tops left attached produced 69 brood per square foot. Felled trees with the boles severed below the crown yielded 85 brood per square foot of bark surface.

Understandably, trees under attack for 10 to 12 days before treatment gave the poorest results. Both the "cut and top" and

Table 1. Southern Pine Beetle Brood Development and Percent Sawyer Feeding per Square Foot of Bark Surface by Treatment

Treatment	Estimated Age of Attack	Southern Pine Beetle Brood per Square Foot	Brood Reduction When Compared to Check	Area Eaten by Sawyer Larvae
	(Days)		(Percent)	(Percent)
Check	—	144	—	25
Cacodylic Acid	1-2	5	97	8
Cacodylic Acid	3-4	60	59	12
Cut and Leave	3-4	69	52	13
Cut and Top	3-4	85	41	20
Cut and Top	10-12	110	24	16
Cut and Leave	10-12	113	13	14

the "cut and leave the top" technique appeared to be better than the check, but only slightly. The "cut and top" technique produced 110 brood per square foot of bark surface whereas the "cut and leave the top" technique gave 113 brood per square foot. The results of all techniques are graphically compared in Figure 1.

Bark samples removed from the trees displayed varying amounts of pine sawyer damage, probably caused by *Monochamus titillator* (F.). Sawyers feed indiscriminately through the inner bark and destroy other insects through ingestion or by competition for available food. The area of sawyer feeding on each bark sample was measured with

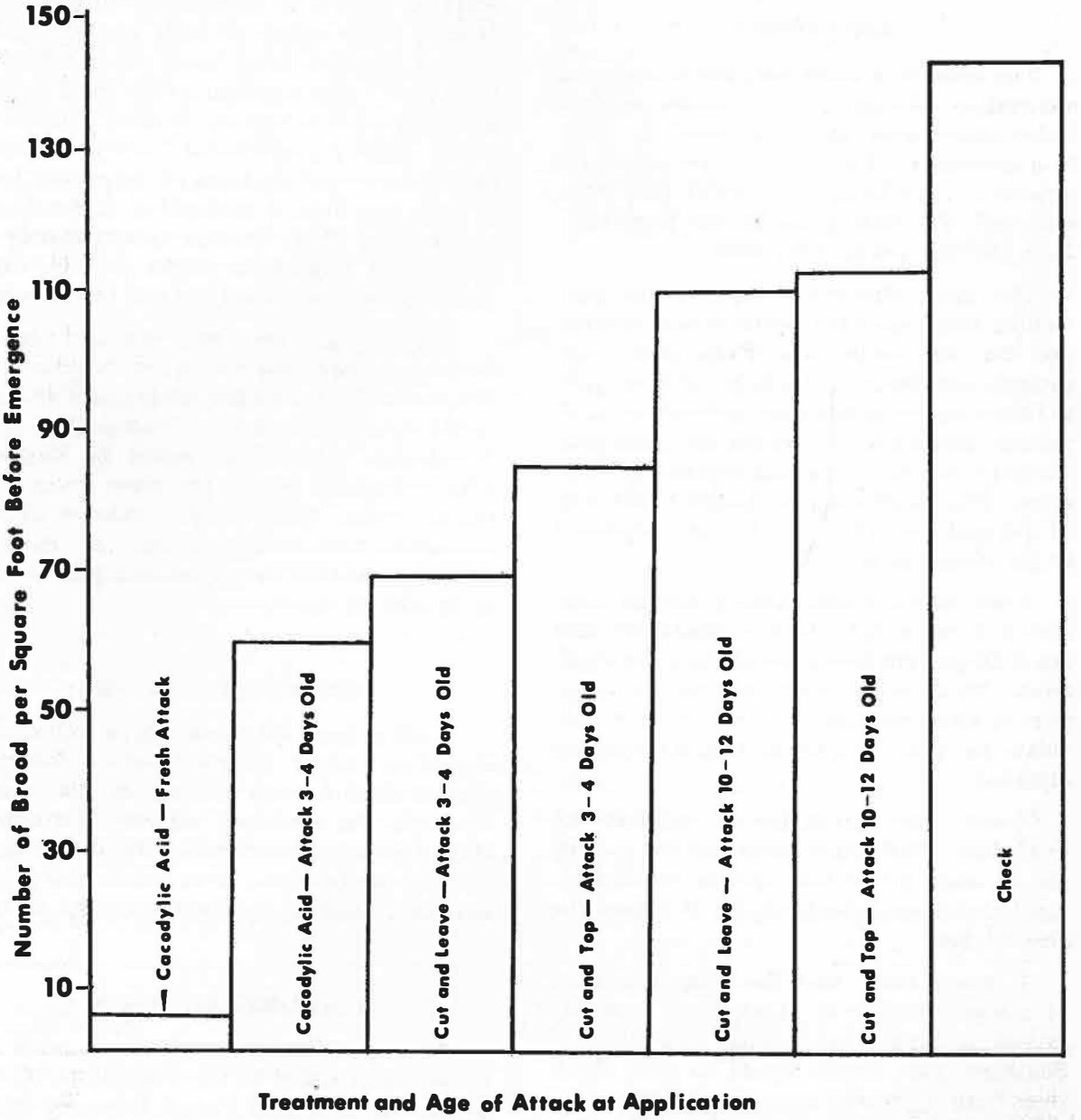
150
130
110
90
70
50
30
10
Number of Brood per Square Foot Before Emergence
Cacodylic Acid — Fresh Attack
Cacodylic Acid — Attack 3–4 Days Old
Cut and Leave — Attack 3–4 Days Old
Cut and Top — Attack 3–4 Days Old
Cut and Leave — Attack 10–12 Days Old
Cut and Top — Attack 10–12 Days Old
Check
Treatment and Age of Attack at Application

FIGURE 1. Effect of Treatment on Development of Southern Pine Beetle Brood Per Square Foot of Bark Surface.

a plastic dot-grid overlay. Results of the measurements are given in Table 1.

Sawyers developed best in the check trees where 25 percent of the inner bark was consumed. Brood trees under attack for 1 to 2 days and treated with cacodylic acid had the least amount of sawyer feeding in bark samples removed before beetle emergence.

CONCLUSION

The field tests were designed to compare alternative Southern pine beetle control techniques where variables could be kept to a minimum. The data are therefore restricted to conditions under which they were collected. The testing period was from mid-June through early July, 1969.

The most effective treatment for controlling Southern pine beetle brood production was an application of cacodylic acid through axe frills in the boles of trees just as they were being attacked by Southern pine beetles. Clerid adults were actively searching the bark for Southern pine beetles on these trees. The Southern pine beetle brood was 97 percent less than the number produced in the check trees.

Trees under beetle attack for an estimated 3 to 4 days before treatment had about 50 percent fewer brood than the check trees. These treatments included an injection of cacodylic acid, fell and cut the bole below the crown, and fell and leave the crown attached.

Trees under attack for an estimated 10 to 12 days which were felled and the crowns cut or were felled and crowns left intact, had brood developments slighly less than the check trees.

It seems likely that the greater amount of sawyer feeding in check trees probably caused a higher percentage reduction of Southern pine beetle brood in the check trees than in treated trees. Therefore, treatments were probably better than the data show.

Application of these findings in an operational control program by East Texas forest landowners would be restrictive by what is currently known. Further tests are needed with different diameter class trees and at different periods of the year. Landowners may conclude, however, that sawlog-sized trees infested in June and July could have brood reduced by different degrees depending on the technique used and the age of the attack at application.

One might speculate that cacodylic acid could be applied to inaccessible infestations after a wider range of tests are complete. Ground checkers could treat newly infested trees plus a few adjacent green trees at the time each spot is located. Return trips on a weekly basis for additional treatment would be necessary until the lapse of one generation. In June and July, a generation of Southern pine beetles would require approximately 4 weeks. An infestation might well be suppressed after one generation and by one man.

The "cut and top" and "cut and leave" techniques can reduce brood production. When combined with the cutting of a 40-foot buffer strip, as currently recommended, small inaccessible infestations might be stopped with remaining brood dispersed from untreated trees. Coupled with salvage of all accessible infestations, integrated control techniques should keep Southern pine beetle outbreaks in check.

RECOMMENDATIONS

Further tests with these three techniques should be made in different timber diameter classes during each season of the year. Through the combined efforts of federal, state and private entomologists, landowners should soon be given more economical alternatives to control the Southern pine beetle.

ACKNOWLEDGMENTS

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